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(12) # EUROPEAN PATENT SPECIFICATION

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(54) **Intraluminal stapling device with tissue gripper.**

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(73) Proprietor: **ETHICON INC.**
U.S. Route 22
Somerville New Jersey 08876(US)

(72) Inventor: **Clanton, Marlene Kay**
250 North Bridge Street
Somerville, N.J. 08876(US)
Inventor: **Kapac, Jeffrey**
248 Wilton Road
Westport Connecticut 06880(US)
Inventor: **Tanaka, Kanuza**
5 Frontier Road
COS COB Connecticut 06807(US)

(74) Representative: **Jones, Alan John et al**
CARPMAELS & RANSFORD 43 Bloomsbury Square
London, WC1A 2RA(GB)

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Description

The present invention relates to intraluminal stapling instruments with a tissue gripper.

Background of The Invention

In recent years there have been developed a number of instruments for placing fasteners in a circular configuration or in a plurality of circular configurations for use in reconnecting severed hollow organs. These devices are used to perform anastomosis; that is, join the cut end of hollow organs or vessels. Whenever the term "vessel" is used throughout this specification it means any hollow tubular organ; such as, intestine, blood vessel, esophagus etc.

Generally speaking, these intraluminal stapling devices comprise a centrally extending longitudinal member on which there is mounted a circular anvil member and a circular staple holding member. These members are separated from one another but are movable along the centrally located member so that they may be placed adjacent each other. To join a severed vessel, one end of the severed vessel is pulled over the anvil portion of the intraluminal device. A purse string suture; that is, a loosely placed suture, is placed around the cut end of the vessel in a manner to act as a purse string so that it may be pulled tight and pulls the loose end of the vessel down tightly about the centrally located member with portions of the vessel or the tissue then disposed directly underneath the anvil of the instrument. The opposite end of the vessel to be joined is pulled over the stapling portion of the instrument in a similar manner. It is also pulled down utilizing a purse string suture so that it is tied against the centrally located member of the instrument and the tissue underlies the staple applying member. At this point, the staple and anvil are moved towards one another to provide a correct gap between the tissues to be joined. Once that correct gap is obtained, the staples are fired, joining the vessel. Staples may be disposed in various arrays, although usually a pair of concentric circles with the staples offset in adjacent circles is used. Once the staples have been fired, a circular knife, which has a smaller diameter than the smallest array of staples that have been fired, severs the tissue inside the staple line and outside the purse string sutures. The anvil and staple holder may then he backed off or separated and the instrument carefully removed from the rejoined vessel. An example of such an instrument is more fully disclosed in U.S Patent No. 4,351,466, issued September 28, 1982.

Another example of a surgical stapling instrument is that described in EP-A-0137685 falling under Article 54(3) EPC. This instrument has a staple cartridge within which is a cylindrical scalpel, a staple anvil mounted on a rod extending from the staple cartridge and shiftable towards the staple cartridge. This instrument also has tissue retention means mounted on the rod accessible between the staple cartridge and the anvil for holding an end of a tubular tissue structure prior to and during an anastomotic procedure.

As can be appreciated from the above description, a critical point in the procedure is to be sure the tissue is positioned up against the central longitudinal extending member of the instrument so that the tissue underlies those portions of the instrument which are used to join the tissue together. Depending on the location of the vessel, size of the vessel, etc., it is often very difficult, if not virtually impossible, to place a suitable purse string suture in a manner so as to ensure good juxtaposition of the vessels.

It is an object of the present invention to provide a simple means for gathering the open end of the vessel. It is a further object of the present invention to provide a means which ensures that the open end of a vessel can be positioned or juxtaposed correctly with respect to a fastening member of an intraluminal device. It is a further object of the present invention to provide means which can readily position the open end of a vessel to be joined simply, and even in the most difficult positions in which to work.

Summary of the Present Invention

What we have discovered is an improved form of intraluminal stapling instrument used to join the open ends of vessels. Such an instrument generally comprises a central longitudinally extending member. Disposed on the central longitudinally extending member are a pair of fastening means. At least one of said fastening means is slidably movable toward and away from the other along the central member. One of the fastening means carries fasteners while the other fastening means is an anvil for crimping the fasteners or otherwise securing the fasteners in place once they are set. It is preferred that the anvil fastening means be slidably movable. In use the instrument is placed within the lumen of the vessel to be joined. One of the fastening means carries a circular array of fasteners disposed about the central member. The fasteners are used to join together and hold the joined vessels together. In the stapling instrument of this invention clamping means cooperates with the central member to grasp the open end of the vessel to be joined and hold the vessel in position adjacent

the central member. The clamping means positions the open end of the vessel beneath the circular array of fasteners whereby when the intraluminal stapling device is actuated, the fasteners engage the vessel adjacent the open end of the vessel. In one embodiment of the present invention, the clamping means comprises a split ring having a plurality of pins extending radially inward from the inside surface of said ring. The clamp preferably comprises two sections hingedly connected to each other at one end thereof and open at the other end thereof. The open end of the clamp may also include a locking feature and preferably an adjustable locking feature. In use, an open end of the vessel to be joined is placed over the slideably movable means of the intraluminal stapling instrument and the clamp placed over the end of the vessel to be joined with the hinge of the clamp in an open position. The open ends of the clamp are brought together causing the clamping means to grasp the vessel and as the clamp is closed the vessel is constricted about the central longitudinally extending member of the intraluminal device to cause the tissue to be positioned underneath or juxtapositioned correctly with respect to the fastening means carrying the circular array of fasteners. In another embodiment of the present invention the clamping device comprises a circular array of barbs extending radially from the central longitudinally extending member of the intraluminal stapling instrument. In use, when the open end of the vessel is placed over the slideably movable means of the instrument, the open end of the vessel is connected to the barbs utilizing forceps to correctly juxtaposition the vessel with regard to the fasteners. As can be appreciated one clamping device may be used to grasp both ends of the vessel to be joined or separate clamping devices may be used or in some instances it may even be desirable to use a clamping device on one end of the vessel to be joined and a purse string suture on the opposite end.

Brief Description of the Drawings

The invention will be more fully described in conjunction with the accompanying drawings wherein:

Figure 1 is a perspective view of one type of intraluminal stapling instrument with which the improvement of the present invention may be used;

Figure 2 is a cross-sectional view of an intraluminal stapling instrument depicting the improvement of the present invention clamping the vessels to be joined in place;

Figure 3 is a view taken along line 3-3 of Figure 2 with certain portions of the vessel removed;

Figure 4 is a perspective view of one type of clamping device of the present invention; and

Figure 5 is an enlarged perspective view of the end portion of an intraluminal stapling instrument showing another type of clamping device of the present invention positioned on said instrument.

Detailed Description of the Drawings

Referring to the drawings, in Figure 1 there is shown a perspective view of an intraluminal stapling instrument 10 according to one embodiment of the present invention. The intraluminal stapling instrument comprises a centrally disposed longitudinally extending member 11. Disposed at one end of the central member is a movable anvil 12 and spaced a distance from the anvil is a fastening member 13 carrying suitable tissue fasteners. At the opposite end of the central longitudinally extending member is means 14 for controlling the distance between the slideably movable anvil and the fastening means 13. Also disposed at the same end is means 15 for firing the fasteners carried by the fastening member 13. In use, the operating end 16 of the instrument is passed entirely through one end of the vessel to be joined. The other portion of the vessel to be joined is slipped over the anvil and usually the vessel tied via a purse string suture down about the centrally extending longitudinal member. The open end of the vessel through which the instrument is passed is also usually tied using a purse string suture about the centrally extending longitudinal member and adjacent the fastening member. The knob 14 at the control end of the instrument is turned to bring the fastening member and the anvil to the correct gap for joining tissue. At this point, the firing means 15 is actuated and the fasteners placed in the tissue. A circular knife is actuated to cut the tissue within the circular array of fasteners. At this point, the knob at the control end is backed off separating the anvil and the fastening member and the instrument gently removed from the reconnected vessel.

As may be more clearly seen in Figures 2 and 3, the instrument has a fastening member 20. One end of the member 20 carries a plurality of fasteners 22, in this instance, metal fasteners, and these metal fasteners are disposed in two circular arrays 23 and 24 of fasteners with the fasteners offset in the arrays. The anvil 25 is movable with respect to member 20. The fastening member 20 also carries a circular knife 26 which is disposed within the inner circular array of fasteners. The fastening member carries suitable pushers and a suitable actuator (not shown) as is well known in the art for actuating both the fasteners and the knife once the fastening member and the anvil are correctly

spaced to join the desired tissue. One end 27 of the vessel to be joined is positioned over the fastening member while the opposite end 37 of the vessel to be joined is positioned over the anvil. The end 27 of the vessel is clamped about the centrally located member by a clamp 28 more clearly shown in Figure 4. The clamp is circular and has an open portion 29 or a split at one point along its periphery. Substantially directly opposite the split is a hinge 30. If desired the clamp could be in two parts but a single hinged piece is usually easier to apply. The inside surface of the clamp contains a plurality of barbs or needles 31. The outer surface of the clamp at the split portion also includes a suitable locking mechanism 32 which is preferably adjustable and in this instance is merely a ratchet mechanism which is disposed on one side of the split and an appropriate grasping mechanism disposed on the opposite side of the split. In use, the clamp 28 is merely placed over the open end of the vessel 27 and about the central member. The clamp is closed and locked to constrict the open end of the vessel about the central longitudinally extending member. A similar clamp 38 is used to constrict the open end of the vessel 37 about the anvil 25. The anvil is moved to the fastening member and the appropriate gap set. The fasteners are placed and the knife actuated. The anvil is backed off and the instrument removed. The clamps may be made from either metal or polymeric material or similar materials as desired.

In Figure 5 there is shown another embodiment of the clamping device of the present invention. In this embodiment the clamp 40 is a ring or collar disposed on the central longitudinally extending member 41 of an intraluminal stapling instrument. Disposed outwardly from the surface of the clamps are a plurality of pins or hooks 42. The open end of the vessel to be joined is brought over the fastening member 43 using forceps and is engaged by the pins 42. A second similar clamp 45 is disposed adjacent the anvil 46 of the instrument. The opposite end of the vessel to be joined is brought over the anvil using forceps and engaged by the hooks 47 of the clamp. The clamps are slidably movable along the member 41 and in a preferred embodiment portions of the fastening member 43 and the anvil 45 adjacent the central member 41 are undercut to allow the fastening member to be brought adjacent the anvil to the required tissue gap and the fasteners then fired to join the vessel.

In certain embodiments, the pins of the clamp may be made from heat shape memory material such as Nitinol or similar alloys so that the pins may have one configuration when the tissue is impaled on the pins and then the pins deformed by heat to take another configuration. The new configuration would be such that the hook grasp the tissue and bring it down about the central longitudinally extending member.

Though we have described utilizing two clamps for joining both the proximal and the distal ends of the vessel, in certain procedures it may be that only one clamp is required. Also in some procedures one clamp may be used for one end of the vessel while the opposite end of the vessel is placed utilizing a purse string suture.

Claims

1. An intraluminal stapling instrument (10) for joining hollow tubular organs, said instrument (10) including a central longitudinally extending member, means (12, 13) disposed on said member for placement within the lumen of a hollow tubular organ to be joined, said means adapted to carry a circular array of fasteners (23, 24) disposed about said central member for joining together and holding the joined hollow tubular organ, which comprises:

   clamping means cooperating with said central member to grasp an open end (27, 37) of the hollow tubular organ to be joined and hold said organ in a constricted position adjacent to the central member and beneath the circular array of fasteners (23, 24) whereby when said instrument is actuated, said fasteners (22) are caused to engage the hollow tubular organ adjacent the open end thereof, and wherein said clamping means comprises a split ring (28, 38) having a plurality of pins (31) extending radially inward from the inside surface of said ring.

2. An instrument according to claim 1 wherein said clamping means has a hinge (30) disposed on the periphery of the ring (28).

3. An instrument according to either of claims 1 and 2 wherein the diameter of the ring (28) is adjustable.

4. An intraluminal stapling instrument for joining hollow tubular organs, said instrument (10) including a central longitudinally extending member (41), means (43, 46) disposed on said member for placement within the lumen of a hollow tubular organ to be joined, said means adapted to carry a circular array of fasteners (23, 24) disposed about said central member for joining together and holding the joined hollow tubular organ, which comprises:

   clamping means (40, 45) cooperating with said central member (41) to grasp an open end of the hollow tubular organ to be joined and

hold said organ in a constricted position adjacent to the central member (41) and beneath the circular array of fasteners (23, 24) whereby when said instrument is actuated, said fasteners (22) are caused to engage the hollow tubular organ adjacent the open end thereof, and wherein said clamping means (40) comprises a circular array of barbs (42, 47) extending radially outward from the central longitudinally extending member (41) of the intraluminal stapling instrument.

5. An instrument according to claim 4 wherein the circular array of barbs (42, 47) is movable longitudinally along said central longitudinally extending member.

6. An instrument according to either of claims 4 and 5 wherein there are two circular arrays of barbs on said longitudinally extending member.

Revendications

1. Une agrafeuse intravasculaire (10) utilisée pour unir des organes tubulaires creux, ladite agrafeuse (10) comprenant un élément central s'étendant de façon longitudinale, un moyen (12, 13) disposé sur ledit élément pour le placement à l'intérieur de l'ouverture d'un organe tubulaire creux devant être uni, ledit moyen étant adapté pour comporter une rangée circulaire d'agrafes (23, 24) disposée autour dudit élément central pour unir et maintenir l'organe tubulaire creux uni, qui comprend :
un moyen de pince coopérant avec ledit élément central pour saisir une extrémité ouverte (27, 37) de l'organe tubulaire creux devant être uni et maintenir ledit organe dans une position resserrée adjacente par rapport à l'élément central et sous la rangée circulaire d'agrafes (23, 24), grâce à quoi lorsqu'on fait fonctionner ledit instrument, lesdites agrafes s'engagent dans l'organe tubulaire creux en position adjacente par rapport à son extrémité ouverte, et dans laquelle le moyen de pince comprend un anneau brisé (28, 38) ayant une pluralité clavettes (31) s'étendant radialement vers l'intérieur à partir de la surface interne dudit anneau.

2. Un instrument selon la revendication 1, dans lequel ledit moyen de pince a une charnière (30) qui est disposée sur la périphérie de l'anneau (28).

3. Un instrument selon l'une des revendications 1 et 2, dans lequel le diamètre de l'anneau (28) est réglable.

4. Une agrafeuse intravasculaire servant à unir des organes tubulaires creux, ladite agrafeuse (10) comprenant un élément central s'étendant longitudinalement (41), un moyen (43, 46) disposé sur ledit élément pour le placement à l'intérieur de l'ouverture d'un organe tubulaire creux devant être uni, ledit moyen étant adapté pour comporter une rangée circulaire d'agrafes (23, 24) disposée autour dudit élément central pour unir et maintenir l'organe tubulaire creux, qui comprend :
un moyen de pince (40, 45) coopérant avec ledit élément central (41) pour saisir une extrémité ouverte de l'organe tubulaire creux devant être uni et maintenir l'organe dans une position resserrée adjacente par rapport à l'élément central (41) et sous la rangée circulaire d'agrafes (23, 24), grâce à quoi lorsqu'on fait fonctionner ledit instrument, lesdites agrafes (22) s'engagent dans l'organe tubulaire creux en position adjacente par rapport à son extrémité ouverte, et dans laquelle ledit moyen de pince (40) comprend une rangée circulaire de barbelures (42, 47) s'étendant radialement vers l'extérieur à partir de l'élément central s'étendant longitudinalement (41) de l'agrafeuse intravasculaire.

5. Un instrument selon la revendication 4, dans lequel la rangée circulaire de barbelures (42, 47) peut se déplacer longitudinalement le long dudit élément central s'étendant longitudinalement.

6. Un instrument selon l'une des revendications 4 et 5, dans lequel il y a deux rangées circulaires de barbelures sur ledit élément s'étendant longitudinalement.

Patentansprüche

1. Ein intraluminales Heftgerät (10) zum Verbinden hohler rohrförmiger Organe, das genannte Gerät (10) umfaßt ein mittleres, sich längs erstreckendes Teil, eine Vorrichtung (12, 13), die auf dem Teil zur Plazierung innerhalb des Lumens eines hohlen, rohrförmigen, zu verbindenden Organs angeordnet ist, wobei die Vorrichtung zum Tragen einer kreisförmigen Reihe von Befestigungsmitteln (23, 34) dient, die um des genannte mittlere Teil zum Miteinanderverbinden und zum Halten des zusammengefügten, hohlen, rohrförmigen Organs angeordnet ist, welches umfaßt:

eine mit dem genannten mittleren Teil zusammenwirkende Klemmvorrichtung zum Erfassen eines offenen Endes (27, 37) des hohlen, rohrförmigen, zusammenzufügenden Organs und zum Halten des Organs in einer eingeschnürten Lage in der Nähe des mittleren Teils und unterhalb der kreisförmigen Reihe von Befestigungsmitteln (23, 24), wodurch, wenn das Gerät betätigt wird, die Befestigungsmittel (22) veranlaßt werden, das hohle, rohrförmige Organ in der Nähe des offenen Endes desselben zu erfassen, und wobei die Klemmvorrichtung aus einem Schlitzring (28, 38) mit einer Mehrzahl von Zapfen (31) besteht, die sich von der Innenseite des Ringes radial nach innen erstrecken.

2. Gerät nach Anspruch 1, bei dem die Klemmvorrichtung ein Scharnier (30) aufweist, das am Umfang des Ringes (28) angeordnet ist.

3. Gerät nach einem der Ansprüche 1 und 2, bei dem der Durchmesser des Ringes (28) einstellbar ist.

4. Ein intraluminales Heftgerät zum Zusammenfügen hohler, rohrförmiger Organe, das genannte Gerät (10) umfaßt einen mittleren, sich längs erstreckenden Teil (41), eine Vorrichtung (43, 46), die auf dem Teil zur Plazierung innerhalb des Lumens eines zusammenzufügenden, hohlen, rohrförmigen Organs angeordnet ist, wobei die Vorrichtung zum Tragen einer kreisförmigen Reihe von Befestigungsmitteln (23, 24) dient, die um den mittleren Teil zum Zusammenfügen und Halten des zusammengefügten, hohlen, rohrförmigen Organs angeordnet ist, welches umfaßt:
eine mit dem mittleren Teil (41) zusammenwirkende Klemmvorrichtung (40, 45) zum Erfassen eines offenen Endes des zusammenzufügenden, hohlen, rohrförmigen Organs und zum Halten des Organs in einer zusammengeschnürten Lage in der Nähe des mittleren Teils (41) und unterhalb der kreisförmigen Reihe von Befestigungsmitteln (23, 24), wodurch, wenn das Gerät betätigt wird, die Befestigungsmittel (22) veranlaßt werden, das hohle, rohrförmige Organ in der Nähe des offenen Endes desselben zu erfassen, und wobei die Klemmvorrichtung (40) aus einer kreisförmigen Reihe Von Widerhaken (42, 47) besteht, die sich radial nach außen von dem mittleren, sich längs erstreckenden Teil (41) des intraluminalen Heftgerätes erstrecken.

5. Gerät nach Anspruch 4, bei dem die kreisförmige Reihe von Widerhaken (42, 47) in Längsrichtung entlang des mittleren, sich längs erstreckenden Teils bewegbar

6. Gerät nach den Ansprüchen 4 oder 5, bei dem zwei kreisförmige Reihen von Widerhaken auf dem sich längs erstreckenden Teil vorgesehen sind.

FIG-1

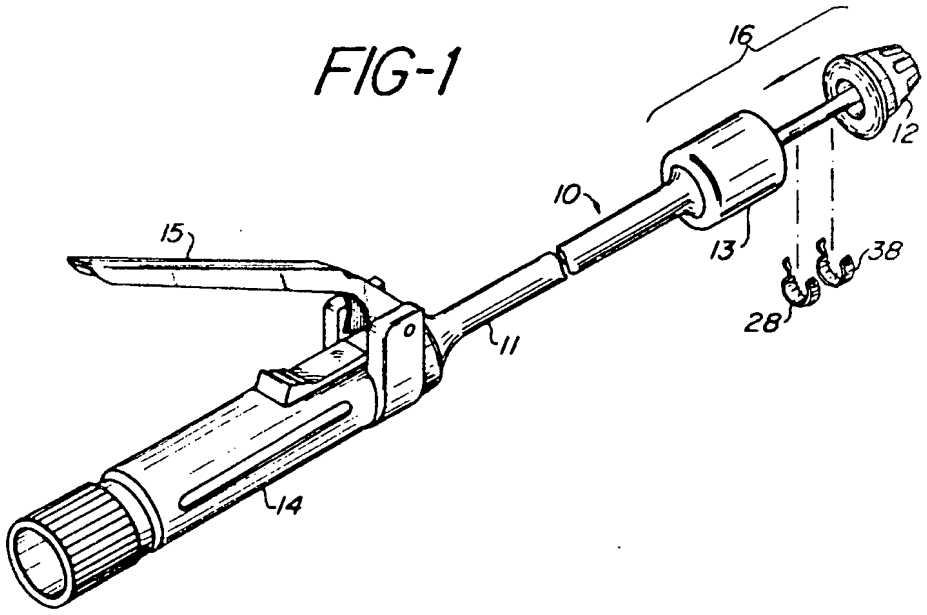


FIG-2

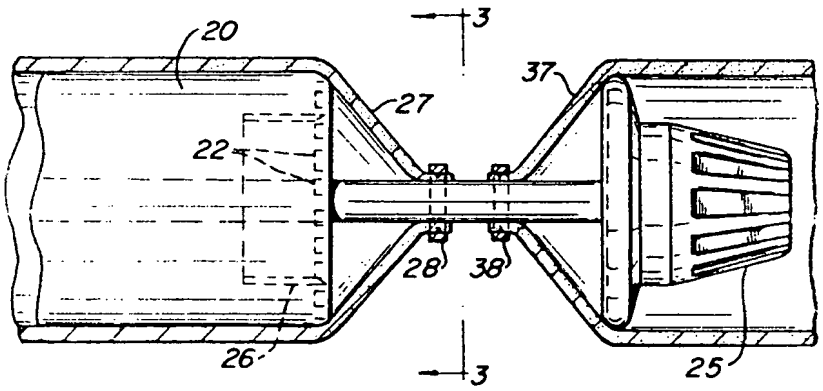


FIG-3

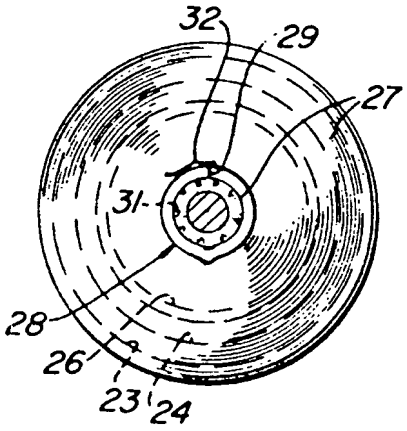


FIG-4

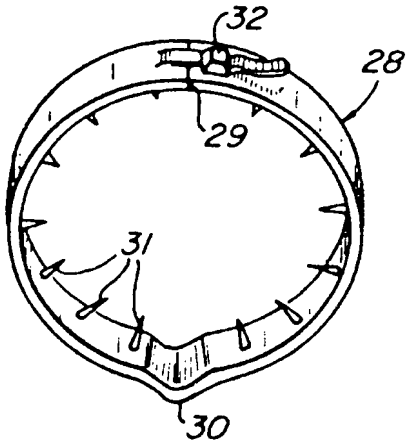
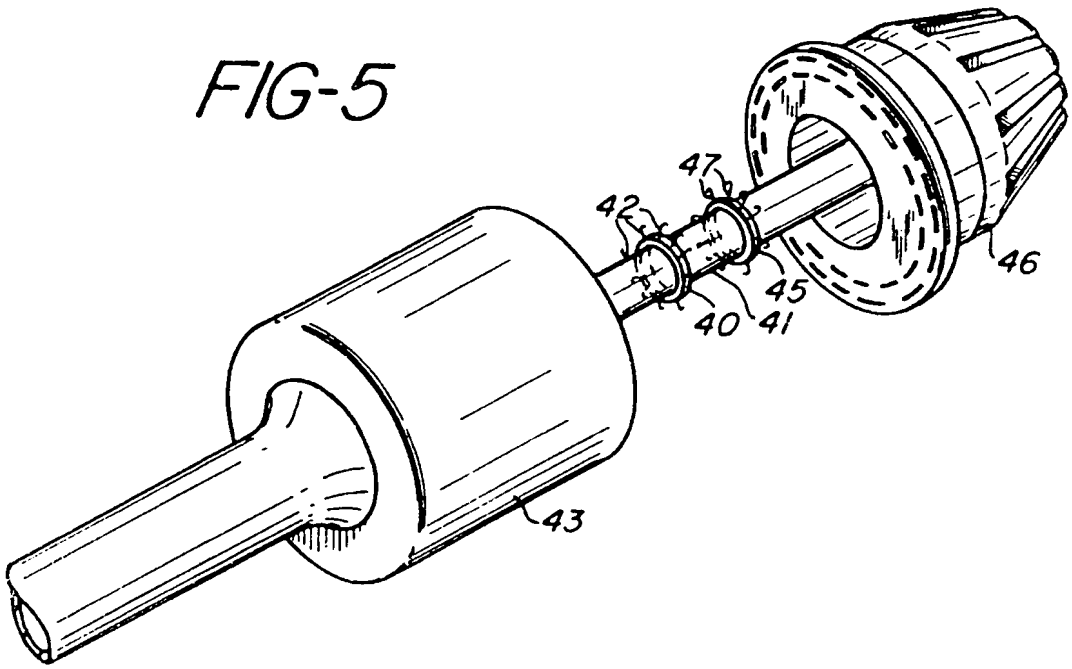


FIG-5



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(54) **Stapling apparatus for anastomosis, in particular for urethra-bladder anastomosis.**

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US-A- 4 294 255	US-A- 4 304 236
US-A- 4 337 775	US-A- 4 485 817
US-A- 4 505 414	US-A- 4 523 592

(73) Proprietor: **AVANT, Odis Lynn**
4703 89th Street
Lubbock Texas 79423(US)

(72) Inventor: **Avant, Odis Lynn**
4703 89th Street
Lubbock Texas 79423(US)
Inventor: **Crawford, Duane A.**
4302 40th Street
Lubbock Texas 79413(US)

(74) Representative: **Pacitti, Pierpaolo A.M.E. et al**
Murgitroyd and Company 373 Scotland Street
Glasgow G5 8QA(GB)

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Description

Background of the Invention

The present invention is in the field of surgical apparatus and methods and is more specifically directed to apparatus and methods for effecting a radical prostatectomy which avoids the shortcomings of the prior known procedures for such operations. The invention is also intended for general use in tubular anastomosis.

Impotence frequently results from radical prostatectomy operations as a consequence of injury to the branches of the pelvic plexus that are necessary for the sexual function. Additionally, incontinence is also regrettably a frequent occurrence resulting from prior known radical prostatectomy procedures. The occurrence of most cases of impotence and incontinence arises as a consequence of three factors inherent in present procedures. The first factor the presently employed surgical procedures involved in the anastomosis of the distal urethra and the bladder neck results in trauma and injury to the nerves adjacent the apex of the prostate and the urethra. The second factor is postoperative leakage resultant from the fact that the anastomosis is frequently not liquid-tight so that urine leaks outside the anastomosis, resulting in scarring and distortion of the bladder neck with possible encasement of the nerves. The third factor is obstructions from intra-lumenal bladder neck contracture.

The prior procedures for effecting anastomosis require the surgeon to suture the urethra in a "blind" area beneath the symphysis pubis in which it is not possible to see the area being sutured. Consequently, imperfect anastomosis and nerve damage frequently result. Moreover, the prior known surgical procedures employed in the anastomosis suffer from the further shortcoming of being extremely time consuming and tedious, factors which decrease the surgeon's skill and the patient's stamina.

While prior devices such as that shown in US Patents Nos 4,304,236, 4,485,817 and 4,553,543 have been proposed for performing anastomosis of large body ducts or lumens such as the bowel, such devices are not usable for joining the smaller body tubes such as the urethra due, among other things, to their large size and the fact that they cannot be scaled down to a sufficiently small size as to be usable in the urethra.

Also the prior art document NL-A-7711347 discloses a device for performing anastomosis using connector components, however these connector components are not both provided with effective support means. The prior device described in US-A-4294255 for performing anastomosis has a connector arrrangement of some complexity which also lacks adequate support means.

Summary of the Invention

The present invention overcomes the aforementioned shortcomings of the prior apparatus and procedures through the provision of a unique apparatus for reconnecting the distal urethra to the bladder neck with a minimum trauma to the branches of the pelvic plexus controlling the sexual function and with almost certain avoidance of urine leakage following the anastomosis.

According to the present invention there is provided an apparatus for effecting anastomosis of two hollow tube-like body members by first and second connector components, said apparatus comprising a first connector component supporting means having a distal end for supporting a first connector component and dimensioned to be inserted in and through a first tube-like body member to position said distal end generally adjacent a part of said first body member to be joined to a second body member; a second connector component supporting means having a distal end and dimensioned to be inserted in and through a second tube-like body member to position its distal end adjacent a portion of said second tube-like body member to be joined to said first body member; cooperating aligning and connecting means for locking their distal ends in axially aligned end-to-end relationship and for clamping said tube-like body members together at their portions to be joined; first and second connector components one of which is mounted on said first connector component supporting means and the other of which is mounted on said second connector component supporting means; drive means for driving one of said connector components to the other of said connector components; said connector components having alignable mating components comprising male means on one connector component and female means on the other connector component which interlock to prevent separation upon movement of the male means into the female means, said drive means causing said male means to penetrate the clamped tube-like body members and enter the female means so as to interlock therewith to effect connection of the two tube-like members, said drive means being on said second connector component supporting means and said first connector component supporting means including an inflatable envelope on which said first connector component is mounted and means for injecting pressurised fluid into said inflatable envelope for rigidifying same so as to resist axial movement of said first connector component when said drive means is activated.

The entire procedure is effected with a minimum chance of damage to the sexual function controlling nerves and with an optimum likelihood of securing a fluid tight connection between the urethra and the bladder. Moreover, the entire procedure can be performed much more quickly than is possible with present known apparatus and methods.

Brief Description of the Drawings

Figure 1A is a perspective view of the human prostate, bladder and associated organs illustrating an initial step in practice of the invention by the preferred embodiment thereof;
Figure 1B illustrates a subsequent step to that of Figure 1A in the practice of the inventive method;
Figure 1C illustrates a step subsequent to the step of Figure 1B in the inventive method;
Figure 1D illustrates a step subsequent to that of Figure 1C;
Figure 1E illustrates a step subsequent to that of Figure 1D;
Figure 1F illustrates a step subsequent to that of Figure 1E;
Figure 2 is a perspective view of the separate components of the preferred apparatus used in practice of the present invention;
Figure 3 is a side elevation view of an annular female connector member;
Figure 4 is a front elevation view of the female connector member of Figure 3;
Figure 5 is a rear elevation view of the female connector member of Figure 3;
Figure 6 is a side elevation view of an annular male connector member;
Figure 7 is a front elevation view of the male connector member of Figure 6;
Figure 8 is a rear elevation view of the male connector member of Figure 6;
Figure 9 is a bisecting sectional view taken along lines 9-9 of Figure 10;
Figure 10 is a sectional view taken along lines 10-10 of Figure 9 and illustrates the positioning of the components in the same position as shown in Figure 1E prior to the actuation of means for effecting connection of the urethra to the bladder;
Figure 11 is a sectional view similar to Figure 10, but illustrating the parts in a subsequent position assumed following actuation of connector effecting means for connecting the posterior urethra end to the bladder wall;
Figure 12 is a bisecting sectional view similar to Figure 10, but illustrating the subsequent step of removal of the connector effecting means away from the juncture of the urethra and the bladder wall following the connection effecting step illustrated in Figure 11;
Figure 13 is an enlarged bisecting sectional view of the connection between the posterior end of the urethra and the bladder; and
Figure 14 is a sectional view taken along the lines 14-14 of Figure 10.

Description of the Preferred Embodiment

Attention is initially invited to Figure 2 which illustrates the different parts of the invention in a pictorial manner and which includes six major components 10, 23, 26, 28, 30 and 32.

More specifically, the main components include an externally manipulated operator 10 and which consists of an elongated rigid hollow tubular catheter or urethral sound 12 having an axial passageway 11 and a threaded aperture or socket 13 at its outer or distal end in which a removable rounded-end tip 14 is mounted. A spool valve 16 is connected by a connector 18 to the opposite end of the elongated hollow catheter or urethral sound 12 and is connected on an opposite side to a syringe or other piston-cylinder means 20 (or other pressure/vacuum means) including an outer cylinder and an internal piston member actuated by an outer thumb know 22 which can be moved axially within the syringe 20 to force fluid therein through valve 16 and then into the elongated hollow catheter 12 for a purpose to be discussed. Also, it should be noted that fluid forced into the catheter 12 can be retained therein by closure of a valve actuator member 17 in an obvious manner.

Other features of the preferred embodiment include an inflatable anvil assembly which is generally designated 23 in Figure 2 and which is connectable to the threaded socket 13 of the elongated hollow urethral sound 12 following removal of the rounded-end tip member 14. More specifically, the inflatable anvil assembly 23 includes an elongated rigid hollow anvil core tube 24 having a threaded end portion 25 which is connectable to the threads in socket 13 in the outer end of the hollow tube member 12 after the tip member 14 has been removed so as to provide communication between the passageway 11 in tube 12 and an internal bore 73 in core tube 24. Hollow anvil tube 24 also includes an outer threaded socket 25' in the outer end portion of tube 24.

Member 30 comprises a conventional flexible catheter having a threaded connector 31 on one end of which is engageable with the threaded socket 25' in the outer end of the hollow core tube 24.

Lastly, a connector actuator 32 includes a main tubular housing 34 having a distal end 33 which is connectable with alignment means on the outer end of the inflatable anvil core tube in a manner to

be described in detail. Actuator 32 is manually activated for effecting connection of the urethra to the bladder by male and female connector means to be discussed. During such actuation, the actuator is coupled to inflatable anvil assembly 23 which is in turn coupled to member 12.

Additionally, the preferred embodiment also includes a circular female connector component 26, and a circular male connector component 28 which two components, 26 and 28, are made of soluble material. The male connector component 28 is engageable with the circular female connector component 26 for connecting the severed end of the urethra to the bladder in a manner to be discussed in detail hereinafter.

The female and male connector components 26 and 28 are both made of a biodegradable soluble material which eventually dissolves in the human body, such as the soluble suture material manufactured by Ethicon, Inc. of Somerville, New Jersey. Other biodegradable polymers that may be used for components 26 and 18 are disclosed in U.S. Patents 3,297,033; 3,463,158; 3,597,449; 3,620,218 and 3,875,937. Initial reference is made to Figures 3, 4 and 5 which illustrate the female connector component 26, The female connector component 26 comprises an annular base plate 36 having an inner surface 38 defining a flow-through opening and an outer surface 40. The annular base plate 36 also has a mounting face 42 from which mounting and positioning pins 44 extend and from which female connector socket tubes 46 also extend with their axes perpendicular to the plane of the annular base plate 36. The face of the annular base plate 36 opposite the mounting face 42 comprises a clamping face 48 from which guide cones 50 extend in axial alignment with respective ones of the female connector tubes 46 with each guide cone including a flared conical surface 52 which is larger at its outer end (the end spaced the greatest distance from clamping face 48) and which merges at its inner end with a respective one of openings 47 extending through each respective female connector tube 46. One-way annular lock ribs 53 are provided on the interior of each axial opening 47 in each tube 46 as shown in Figure 10. Additionally, four oval clamping dimples 54 extend outwardly from the clamping face 48.

The circular male connector component 28 illustrated in Figures 6, 7 and 8 includes an annular base plate 56 which is of the same size and shape as annular base plate 36 of the female connector and includes an inner surface 58 defining an opening in alignment with (when mounted in the assembly) and in exactly the same size as the opening defined in the base plate 36 by surface 38. The annular base plate 36 includes a mounting face 60 from which four mounting and positioning pins 62 extend. An opposite clamping face 64 is provided with four outwardly extending male connector pins 66 each having a plurality of conical flanges each defining a circular outer lip 68 having a diameter slightly greater than the diameter of the one-way annular lock ribs 53 extending the length of the female connector tubes 46, but not being deflectable during insertion of the male connector pins through the opening 47 in the female connector tube. After insertion of the male connector pins, ribs 53 and lips 68 interact to prevent removal of the connector pins 66 from the female connector tubes 46. Additionally, clamping face 64 also includes four oval clamping dimples 70 which are of identical size and shape to that of dimples 54 of the female connector. The dimples 70 are positioned to face the flat surface 48 of the female connector component 26 and are not in alignment with the dimples 54 of the female connector component when the female and male connector components are connected together in a manner to be discussed.

The rigid anvil core tube 24 of the inflatable anvil assembly 23 has axial bore 73 which communicates with a plurality of radial bores 92 found in core tube 24. A ring seal 76 is provided between the end of the elongated hollow tube 12 and a shoulder 78 on the outer surface of tube 24 as best shown in Figure 12 for example. An inflatable anvil bladder 80 encircles the tube 24 and has a base end 82 positioned in a recessed seat 84 provided in the outer surface of the core tube 24 with a clamp band 86 clamping the base in 82 in a pressure resistant manner to the outer surface of the tube 72 as shown in Figure 12. The inflatable anvil bladder 80 is unitarily formed preferably of polyethylene material such as that used in inflatable catheters sold by American Edwards Laboratories of Santa Ana, California, and includes major components comprising an outer envelope 81, a radial annular clamp portion 83 and in an interior envelope 88 which is generally of conical configuration when the anvil bladder is in its inflated rigid condition illustrated in Figure 10. The inner end 90 of the interior envelope portion 88 is molded to the outer surface of core tube 24 and is normally in a tensioned condition so as to maintain a fluid tight seal (under high pressure) between the inner end 90 and the outer surface of tube 24. Alternatively, a metal clamp could also be used for clamping end 90 to the outer surface of core tube 24 if desired.

Radial apertures 92 are provided in tube 24 to provide pressure-vacuum communication with the axial bore internal passageway 73 so that fluid provided into the passageway 73 flows outwardly into the space between the inner surface of the outer envelope 81 and the interior envelope 88 and the outer surface of the tube 24 between the seal-

ed portions 82 and 90 as shown in Figure 10. Additionally, mounting sockets 93 are sized and positioned to receive the positioning pins 44 of the circular female connector 26 for holding same in position for permitting connection of the male connector as will be discussed.

Additionally, the inflatable anvil bladder 80 includes radial strengthening vanes 95 molded to tube 24 as shown in Figure 14; however, it should be understood that vanes 95 are optional and may not be essential to successful operation of the device. Further, an alignment lug 108, is provided near the outer end of the metal tube 24 for engagement with a mating slot 110 provided in an internal support sleeve 112 of the actuator device 32. Radial bore 100 provided at the outer end of axial bore 73 communicates with an annular space within the confines of an annular locking bladder 96 which is clamped in a grove 102 at opposite ends by clamp members 104 and 106 (Figure 11) so that pressure introduced into bore 73 tends to bulge the annular locking bladder 96 outwardly for a purpose to be discussed.

Internal support sleeve 112 of the actuator 32 is fixedly and axially positioned within an enlarged head 33 provided on the end of a main tubular housing 34 of actuator 32 and provides support for a sliding drive tube 114 which is mounted on sleeve 112 for reciprocation between two positions respectively illustrated in Figures 10 and 11. It will be observed that drive tube 114 includes a slot 116 in which a stop pin 118 is positioned for limiting the extent of movement of the drive tube 114. A cylindrical blade 120, having a sharp circular outer edge 122, is attached to the forward end of the drive tube 114 for movement therewith. The outer diameter of the circular blade 120 is slightly less than the inner diameter of the opening provided in the male connector member 28 and the head 33 is provided with a plurality of pin receiving support openings 124 for receiving the pins 62 of the male connector members so that the male connector pins 66 are supported in axial alignment with the openings 47 of the female connector members.

The drive tube 114 is reciprocated by conventional drive means such as, for example, drive means employed in existing surgical stapler devices. An example of a satisfactory drive means is that shown in U.S. Patent No. 4,304,236 for driving tube 50 of said patent. Alternatively, a dual-handle drive assembly as shown in phantom in Figure 2 or a hydraulic system similar to that of U.S. Patent No. 4,485,817 or a mechanical system as in U.S. Patent No. 4,204,623 could be employed.

The manner of using the inventive apparatus will now be discussed with initial reference being made to Figure 1A. The patient will be anesthetized and the removable rounded-end tip 14 will be threaded into the end of the elongated urethral sound 12. Conventional surgical techniques employing a verticle infra umbilical incision will be employed to render the bladder B and the urethra U accessible to the surgeon as shown in Figure 1A. Elongated hollow urethral sound 12 will then be inserted externally from the outer end of the urethra through the urethra to a position substantially as shown in Figure 1A, but will be inside the urethra with the forward end 14 extending into the apex of the prostate P. Dorsal vein V is then ligated and transected and an initial urethrotomy 130 is then provided in the urethra of sufficient size to permit the end tip 14 and the outer portion of urethral sound 12 to be pushed outwardly through the urethrotomy 130, as shown in Figure 1A; however, it should be understood that the urethra is not completely transected at this time. The removable rounded-end tip member 14 is then removed from the tube 12 and will not be of any further use in the procedure.

The deflated inflatable anvil assembly 23 and a female connector component 26 mounted thereon are then threaded into the internally threaded socket 13. The urethral sound 12 is then moved outwardly and the assembly is manipulated to fully position the inflatable means 81, 88 of the inflatable anvil assembly 23 inside the urethra with the end of core tube 24 protruding outwardly through the urethrotomy 130, as shown in Figure 1B. The urethra is snugly engaged with the outer surface of protruding core tube 24 by a suture, as shown at 132, with the end of core tube 24 extending outwardly beyond the urethra. Catheter 30 is then threaded into socket 13 and the urethra is completely severed to provide a severed end 130 as shown in Figure 1C. The prostate is then peeled back toward the head end and the distal vein complex C and the prostate are severed from the bladder to leave an elongated opening having sides 136 and 138 as shown in Figure 1C.

A cystotomy 140 is provided in an upper portion of the bladder B and the actuator housing 34 is passed downwardly through the cystotomy to position head 33 and a male connector component 28 mounted therein in the bladder shown in Figure 1D. The area inside the head 33 of the actuator will be as shown in Figure 10 with the male connector member 28 being positioned within the head. The end of the catheter will then be passed upwardly into the internal sleeve 112 and alignment lug 108 will be positioned in slot 110 to insure the male connector pins of the male connector component 28 are axially aligned with the openings 47 in the female connector component 26.

Valve 16 is then opened and syringe 20 actuated to force fluid 94, such as a sterile saline solution, through the tubes 12 and 24 to inflate the

inflatable anvil bladder 80 so that it assumes the shape shown in Figure 10. Inflation of anvil bladder 80 causes the bladder to expand outwardly to radially distend the urethra against the dorsal vein to effect substantial compressive closure of the vein and permit relegation of the vein if necessary. Optionally, the initial ligation and transection of the dorsal vein can be performed at this time instead of immediately following the urethral sound as discussed above.

Injection of fluid into core tube 24 will also cause the annular locking bladder 96 to bulge outwardly into contact with the inner surface of internal sleeve 112 to rigidly lock members 24 and 112 together so as to prevent any relative axial movement of core tube 24 relative to sleeve 112. Valve 16 will then be closed to maintain pressure inside the anvil member so that it remains in its inflated condition. The male connector 28 is consequently insured of remaining in proper alignment with the female connector 26 by virtue of the fact that the positioning of lug 108 in slot 110 cannot be discontinued.

Suturing of the sides 136 and 138 together is completed to provide an opening through the bladder wall which is in the form of a circular neck portion of bladder tissue 148 engaging the outer surface of core tube 24 as shown in Figure 1. Similarly, the urethra has tissue portions 150 engaging the outer surface of core tube 24 and resting against annular stop 98, fixed to tube 24 as shown in Figure 10. The entire assembly is consequently ready for actuation to effect a connection between the bladder and the urethra.

The conventional drive means in actuator 32 is then actuated to cause the drive tube 114 to move to the left in the direction of arrow A in Figure 11 from its position on support tube 112 in Figure 10 to the position shown in Figure 11. Such movement affects two very important operations. Firstly, the male connector member is forcefully moved so that the male connector pins 66 penetrates the bladder and the urethral tissue and then moves into and through the openings in the female connector tubes 46 and are locked therein so as to clamp the bladder to the end of the urethra. Secondly, the movement of the circular blade 120 severs the portions 148 and 150 of the bladder and urethra, to respectively provide smooth edge surfaces 158 and 160, respectively, and the severed portions move into the interior of the blade as shown in Figure 11 where they remain for subsequent availability in biopsy purposes if desired. In addition, the cutter removes tissue in a circular fashion providing a clean-cut interior lumenal circumference for the anastomosis which would minimize flow obstruction and maintain a superior hydraulic radius to flow.

Valve 16 is then opened and syringe 20 actuated to withdraw the fluid from inside the inflatable anvil bladder 80 and the annular locking bladder 96. Actuator 32 is withdrawn through the access opening 140 and the opening is sutured or stapled together as shown at 151. The urethral sound 12 is then moved outwardly through the urethra with such movement pulling the anvil assembly 23 and catheter 30 outwardly with the sound. Outward movement of the urethral sound 12 is terminated after connector 31 clears the urethra meatus and the connector 31 is disconnected from the threaded socket 25 so as to leave the catheter 30 in position for effecting bladder drainage. After several days, the catheter 30 can be removed in a well known manner. The male and female urethra and bladder have grown together to provide a permanent connection therebetween.

While the preferred embodiment of the invention is directed to prostate removal, it should be understood that the invention is not limited to prostate operations. In fact, the inventive apparatus can be employed for joining other tubular body parts such as the esophagus, intestines, urethra, bowel ducts and the like. Also, the invention can be employed for joining the urethra of females to repair traumatic injury such as may occur in accidents or occasionally in childbirth.

Claims

1. An apparatus for effecting anastomosis of two hollow tube-like body members by first and second connector components (26),(28), said apparatus comprising a first connector component supporting means (23) having a distal end (24) for supporting a first connector component (26) and dimensioned to be inserted in and through a first tube-like body member (U) to position said distal end (24) generally adjacent a part of said first body member (U) to be joined to a second body member (B); a second connector component supporting means (32) having a distal end (33) and dimensioned to be inserted in and through a second tube-like body member (B) to position its distal end (33) adjacent a portion of said second tube-like body member (B) to be joined to said first body member (U); cooperating aligning and connecting means for locking their distal ends in axially aligned end-to-end relationship and for clamping said tube-like body members (U)-,(B) together at their portions to be joined; first and second connector components (26),(28) one of which is mounted on said first connector component supporting means (23) and the other of which is mounted on said second connector component supporting means (32);

drive means (114) for driving one of said connector components (28) to the other of said connector components (26); said connector components (26), (28) having alignable mating components comprising male means on one connector component (28) and female means on the other connector component (26) which interlock to prevent separation upon movement of the male means into the female means, said drive means (114) causing said male means to penetrate the clamped tube-like body members (U), (B) and enter the female means so as to interlock therewith to effect connection of the two tube-like members (U), (B), said drive means (114) being on said second connector component supporting means (32) and said first connector component supporting means (23) including an inflatable envelope on which said first connector component (26) is mounted and means (20) for injecting pressurised fluid into said inflatable envelope for rigidifying same so as to resist axial movement of said first connector component (26) when said drive means (114) is activated.

2. The apparatus of claim 1, wherein each of said connector components (26),(28) has a base plate (36),(56) of generally annular configuration on which said male means and female means are respectively mounted.

3. The apparatus of claim 2, wherein said first and second connector components (26),(28) are formed of material which dissolves in response to being positioned in the human body for a predetermined minimum time period.

4. The apparatus of claim 3 additionally including annular knife means (120) mounted on said drive means (114) engaging and severing said annular tissue portions of said tube-like body members (U),(B) along a cylindrical surface radially inward of the tissue portions of the clamped tube-like body members (U),(B) penetrated by the male means.

5. The apparatus of claim 3 additionally including catheter means (30) positioned internally of said second connector component supporting means (32) and having one end connected to the distal end (24) of said first connector component supporting means (23).

6. The apparatus of claim 1, wherein each of said connector components (26),(28) has a base plate (36),(56) of generally annular configuration on which said male means and female means are respectively mounted.

7. The apparatus of claim 6 additionally including annular knife means (120) mounted on said drive means (114) engaging and severing said annular tissue portions of said tube-like body members (U),(B) along a cylindrical surface radially inward of the tissue portions of the clamped tube-like body members (U),(B) penetrated by the male means.

8. The apparatus of claim 7 additionally including catheter means (30) positioned internally of said second connector component supporting means (32) and having one end connected to the distal end (24) of said first connector component supporting means (23).

9. The apparatus of claim 1 wherein said first tube-like body member (U) is the human urethra and said second tube-like body member (B) is the human bladder.

Patentansprüche

1. Vorrichtung zum Bewirken einer Anastomose von zwei hohlen röhrenähnlichen Körperteilen durch erste und zweite Verbindungsbauteile (26), (28), wobei die Vorrichtung eine das erste Verbindungsbauteil abstützende Einrichtung (23) aufweist, die ein fernes Ende (24) zum Abstützen eines ersten Verbindungsbauteils (26) hat und derart dimensioniert ist, daß sie in und durch ein erstes röhrenähnliches Körperteil (U) eingesetzt werden kann, um das ferne Ende (24) im wesentlichen neben einem Teil des ersten Körperteils (U) zu positionieren, der mit einem zweiten Körperteil (B) zu verbinden ist; eine das zweite Verbindungsbauteil abstützende Einrichtung (32), die ein fernes Ende (33) hat und derart dimensioniert ist, daß sie in und durch ein zweites röhrenähnliches Körperteil (B) eingesetzt werden kann, um ihr fernes Ende (33) neben einem Bereich des zweiten röhrenähnlichen Körperteils (B) zu positionieren, der mit dem ersten Körperteil (U) zu verbinden ist; zusammenwirkende Ausrichtungs- und Verbindungsmittel zum Verriegeln ihrer fernen Enden in einer axial fluchtenden Ende-an-Ende-Anordnung und zum Zusammenklemmen der röhrenähnlichen Körperteile (U), (B) an ihren zu verbindenden Bereichen; erste und zweite Verbindungsbauteile (26), (28), von denen eines an der ersten Abstützeinrichtung (23) für das erste Verbindungsbauteil angeordnet ist und das andere an der zweiten Verbindungseinrichtung (32) für das zweite Verbindungsbauteil angeordnet ist; eine Antriebseinrichtung (114) für einen Antrieb eines der Verbindungsbauteile (28) zu dem anderen der

Verbindungsbauteile (26); wobei die Verbindungsbauteile (26), (28) wechselseitig ausrichtbare, zusammenpassende Komponenten mit einer männlichen Einrichtung an dem einen Verbindungsbauteil (28) und einer weiblichen Einrichtung an dem anderen Verbindungsbauteil (26) haben, die sich gegenseitig verriegeln, um bei der Bewegung der männlichen Einrichtung in die weibliche Einrichtung eine Trennung zu verhindern, wobei die Antriebseinrichtung (114) die männliche Einrichtung für ein Durchdringen der verklemmten röhrenähnlichen Körperteile (U), (B) und einen Eintritt der weiblichen Einrichtung beeinflußt, sodaß es damit zu einer Verriegelung kommt, um die Verbindung der beiden röhrenähnlichen Teile (U), (B) zu bewirken, wobei die Antriebseinrichtung (114) an der Abstützeinrichtung (32) für das zweite Verbindungsbauteil ist und die Abstützeinrichtung (23) für das erste Verbindungsbauteil eine aufblasbare Umhüllung aufweist, an welcher das erste Verbindungsbauteil (26) angeordnet ist, sowie eine Einrichtung (20) für eine Injektion eines Druckfluids in die aufblasbare Umhüllung, um diese zu versteifen, sodaß sie einer axialen Bewegung des ersten Verbindungsbauteils (26) widersteht, wenn die Antriebseinrichtung (114) aktiviert wird.

2. Vorrichtung nach Anspruch 1, bei welcher jedes der Verbindungsbauteile (26), (28) eine Grundplatte (36), (56) einer im wesentlichen ringförmigen Gestaltung hat, an welcher die männliche Einrichtung und die weibliche Einrichtung angeordnet sind.

3. Vorrichtung nach Anspruch 2, bei welcher die ersten und zweiten Verbindungsbauteile (26), (28) aus einem Material ausgebildet sind, welches sich in Abhängigkeit von der Postitionierung in dem menschlichen Körper über eine vorbestimmte minimale Zeitdauer auflöst.

4. Vorrichtung nach Anspruch 3, welche zusätzlich eine ringförmige Messereinrichtung (120) aufweist, die an der Antriebseinrichtung (114) angeordnet ist und mit ringförmigen Gewebebereichen der röhrenähnlichen Körperteile (U), (B) in Eingriff kommt, um diese längs einer zylindrischen Oberfläche radial innerhalb der Gewebebereiche der verklemmten röhrenähnlichen Körperteile (U), (B) abzutrennen, die von der männlichen Einrichtung durchdrungen sind.

5. Vorrichtung nach Anspruch 3, welche zusätzlich eine Kathetereinrichtung (30) aufweist, die innerhalb der Abstützeinrichtung (32) für das zweite Verbindungsbauteil angeordnet ist und deren eines Ende mit dem fernen Ende (24) der Abstützeinrichtung (23) für das erste Verbindungsbauteil verbunden ist.

6. Vorrichtung nach Anspruch 1, bei welcher jedes der Verbindungsbauteile (26), (28) eine Grundplatte (36), (56) einer im wesentlichen ringförmigen Gestaltung hat, an welcher die männliche Einrichtung und die weibliche Einrichtung angeordnet sind.

7. Vorrichtung nach Anspruch 6, welche zusätzlich eine ringförmige Messereinrichtung (120) aufweist, die an der Antriebseinrichtung (114) angeordnet ist und mit ringförmigen Gewebebereichen der röhrenähnlichen Körperteile (U), (B) in Eingriff kommt, um diese längs einer zylindrischen Oberfläche radial innerhalb der Gewebebereiche der verklemmten röhrenähnlichen Körperteile (U), (B) abzutrennen, die von der männlichen Einrichtung durchdrungen sind.

8. Vorrichtung nach Anspruch 7, welche zusätzlich eine Kathetereinrichtung (30) aufweist, die innerhalb der Abstützeinrichtung (32) für das zweite Verbindungsbauteil angeordnet ist und deren eines Ende mit dem fernen Ende (24) der Abstützeinrichtung (23) für das erste Verbindungsbauteil verbunden ist.

9. Vorrichtung nach Anspruch 1, bei welcher das erste röhrenähnliche Körperteil (U) die menschliche Harnröhre und das zweite röhrenähnliche Körperteil (B) die menschliche Blase ist.

Revendications

1. Appareil pour effectuer l'anastomose de deux membres de corps en forme de tube creux par un premier et un second composants connecteurs (26), (28), ledit appareil comprenant un premier moyen support (23) de composant connecteur ayant une extrémité distale (24) pour supporter un premier composant connecteur (26) et dimensionné pour être inséré à l'intérieur et au travers d'un premier membre de corps (U) en forme de tube pour positionner ladite extrémité distale (24) en position généralement adjacente à une partie dudit premier membre de corps (U) à relier à un second membre de corps (B) ; un second moyen support (32) de composant connecteur ayant une extrémité distale (33) et dimensionné pour être inséré à l'intérieur et au travers d'un second membre de corps (B) en forme de tube

pour positionner son extrémité distale (33) en position adjacente à une portion dudit second membre de corps (B) en forme de tube à relier audit premier membre de corps (U) ; des moyens de coopération en alignement et en connection pour verrouiller leurs extrémités distales en des positions bout à bout alignées axialement et pour serrer lesdits membres de corps (U), (B) en forme de tube ensemble selon leurs portions à relier ; des premier et second composants connecteurs (26), (28) l'un d'entre eux étant monté sur ledit premier moyen support (23) de composant connecteur et l'autre étant monté sur ledit second moyen support (32) de composant connecteur ; un moyen d'actionnement (114) pour déplacer l'un desdits composants connecteurs (28) jusqu'à l'autre desdits composants connecteurs (26); lesdits composants connecteurs (26), (28) ayant des composants d'accouplement alignables comprenant un moyen mâle sur l'un des composants connecteurs (28) et un moyen femelle sur l'autre des composants connecteurs (26) et qui s'enclenchent l'un à l'autre pour empêcher la séparation par un mouvement du moyen mâle à l'intérieur du moyen femelle, ledit moyen d'actionnement (114) faisant pénétrer ledit moyen mâle dans les membres de corps (U), (B) serrés en forme de tube et le faisant entrer dans le moyen femelle de façon à s'emboiter avec lui pour assurer la connection des deux membres (U), (B) en forme de tube, ledit moyen d'actionnement (114) étant sur ledit second moyen support (32) de composant connecteur et ledit premier moyen support (23) de composant connecteur comprenant une enveloppe gonflable sur laquelle ledit premier composant connecteur (26) est monté et des moyens (20) pour injecter un fluide sous pression à l'intérieur de ladite enveloppe gonflable pour la rigidifier de façon à résister au mouvement axial dudit premier composant connecteur (26) lorsque ledit moyen d'actionnement (114) est activé.

2. Appareil selon la revendication 1, dans lequel chacun desdits composants connecteurs (26), (28) comprend une plaque de base (36), (56) de configuration généralement annulaire sur laquelle ledit moyen mâle et ledit moyen femelle sont respectivement montés.

3. Appareil selon la revendication 2, dans lequel lesdits premier et second composants connecteurs (26), (28) sont formés d'un matériau qui se dissout à la suite de son positionnement dans le corps humain à l'issue d'une période de temps minimum prédéterminée.

4. Appareil selon la revendication 3, comprenant en outre un moyen de couteau annulaire (120), monté sur ledit moyen d'actionnement (114), venant au contact et coupant lesdites portions annulaires de tissu desdits membres de corps (U), (B) en forme de tube le long d'une surface cylindrique radialement à l'intérieur des portions de tissu des membres de corps (U), (B) serrés en forme de tube pénétrés par le moyen mâle.

5. Appareil selon la revendication 3, comprenant en outre un moyen de cathéter (30) positionné à l'intérieur dudit second moyen support (32) de composant connecteur et ayant une extrémité connectée à l'extrémité distale (24) dudit premier moyen support (23) de composant connecteur.

6. Appareil selon la revendication 1, dans lequel chacun desdits composants connecteurs (26), (28) a une plaque de base (36), (56) de configuration généralement annulaire sur laquelle ledit moyen mâle et ledit moyen femelle sont respectivement montés.

7. Appareil selon la revendication 6, comprenant en outre un moyen de couteau annulaire (120), monté sur ledit moyen d'actionnement (114), venant au contact et coupant lesdites portions de tissu annulaire desdits membres de corps (U), (B) en forme de tube le long d'une surface cylindrique radialement intérieure aux portions de tissu des membres de corps (U), (B) serrés en forme de tube pénétrés par le moyen mâle.

8. Appareil selon la revendication 7, comprenant en outre un moyen de cathéter (30) positionné à l'intérieur dudit second moyen support (32) de composant connecteur et ayant une extrémité connectée à l'extrémité distale (24) dudit premier moyen support (23) de composant connecteur.

9. Appareil selon la revendication 1, dans lequel ledit premier membre de corps (U) en forme de tube est l'urètre humain et ledit second membre de corps (B) en forme de tube est la vessie humaine.

FIG-1A

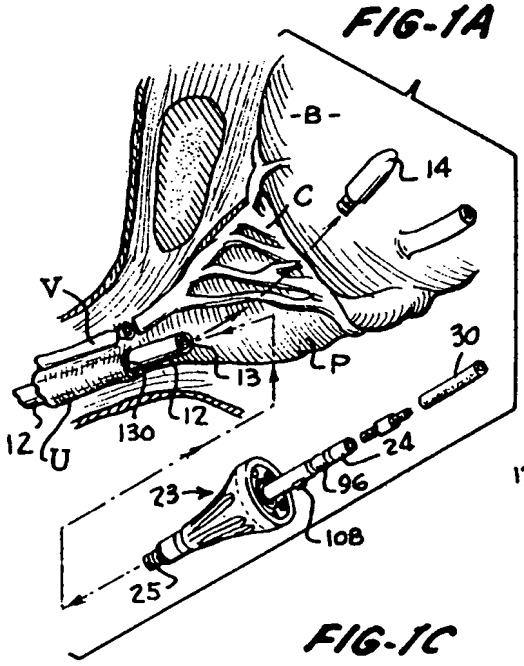


FIG-1B

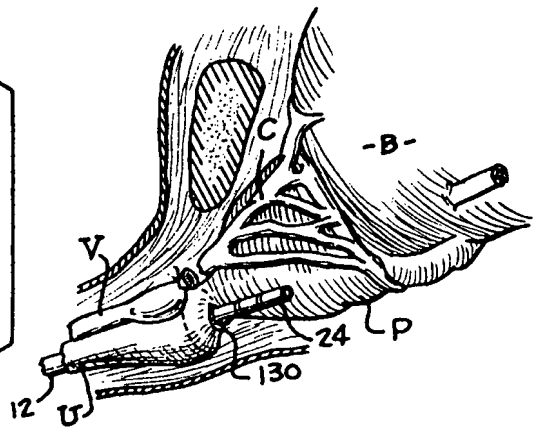


FIG-1C

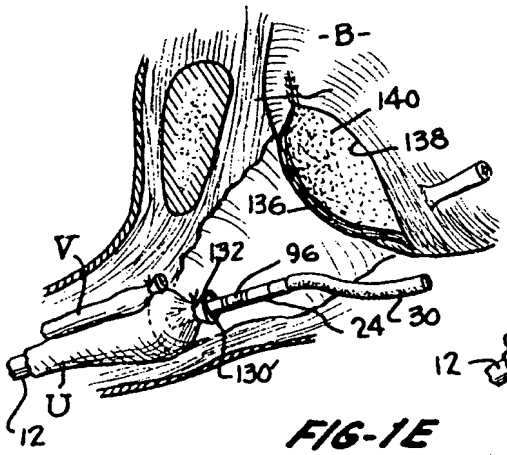


FIG-1D

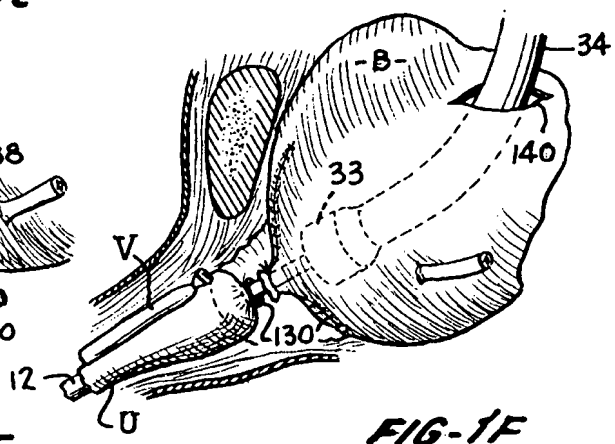


FIG-1E

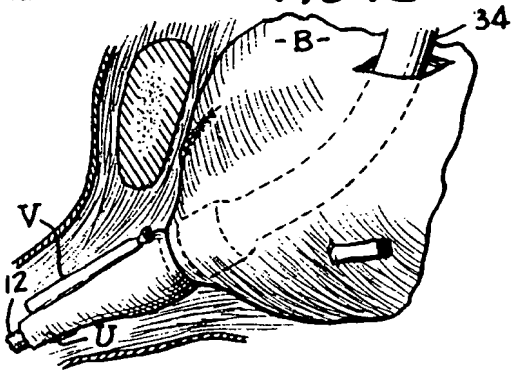
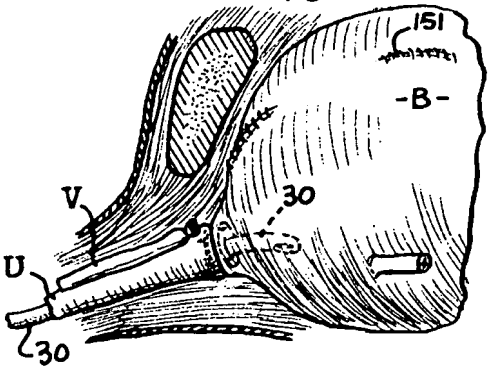


FIG-1F



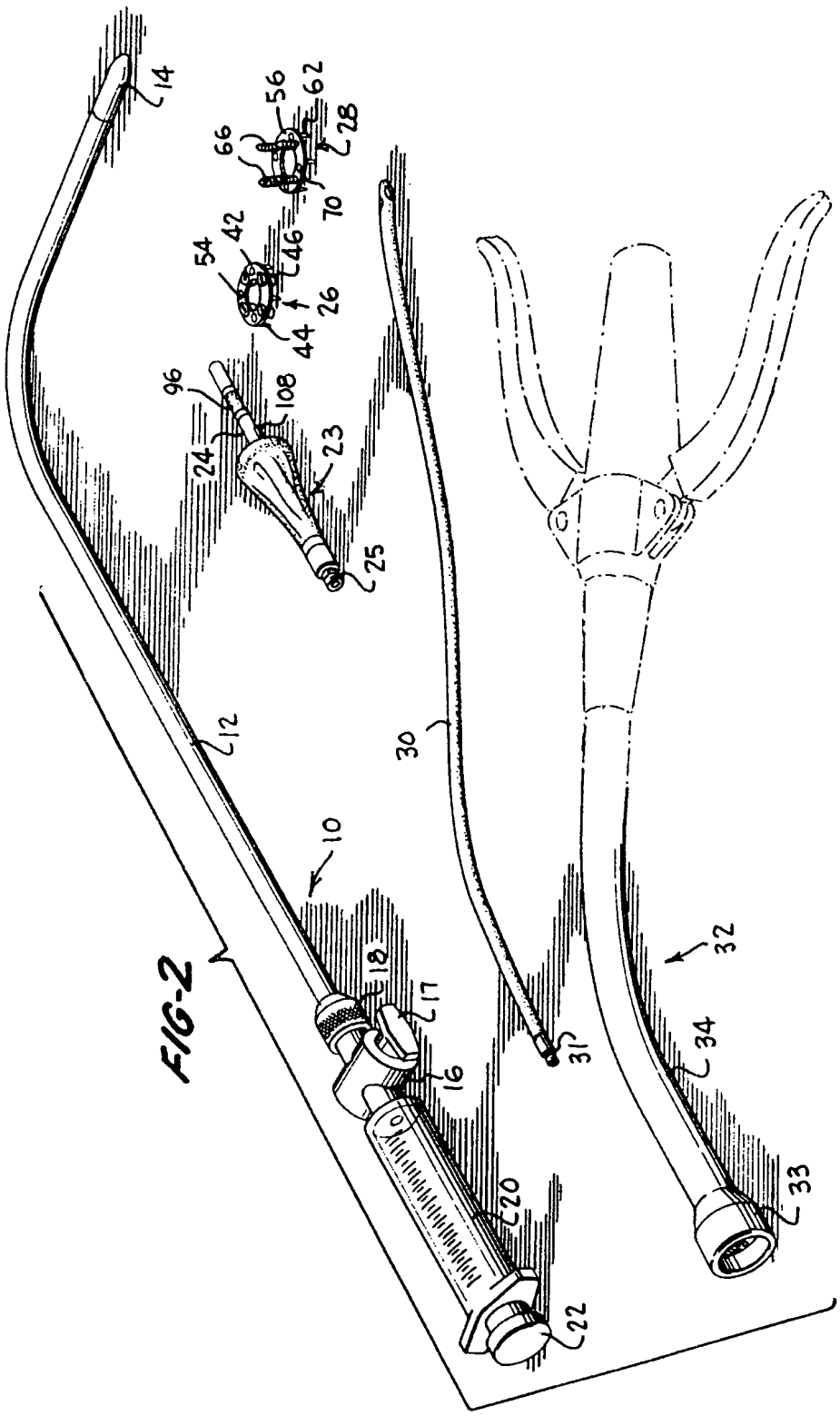

14
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FIG-2

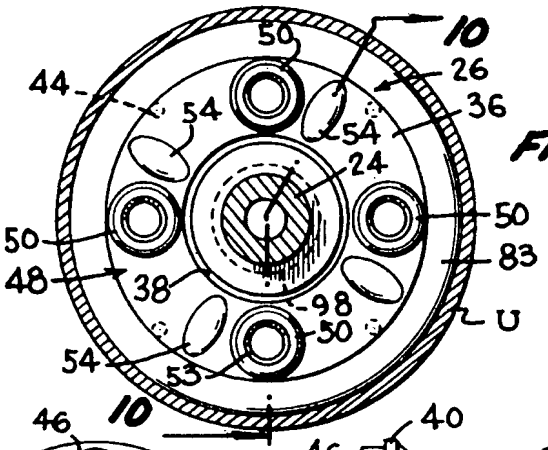

FIG-9

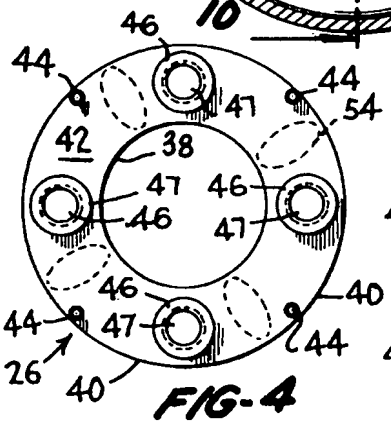

FIG-4

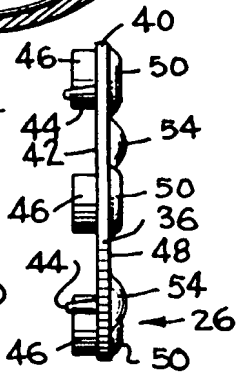

FIG-3

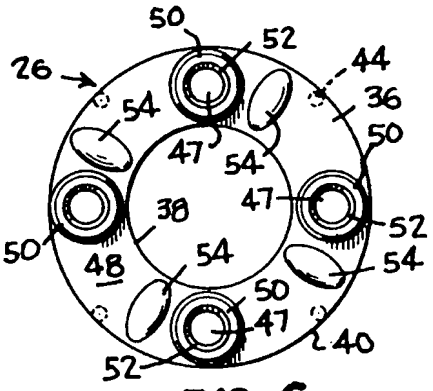

FIG-5

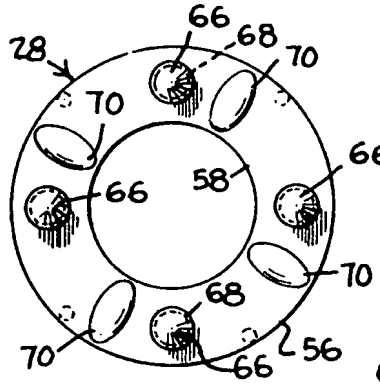

FIG-7

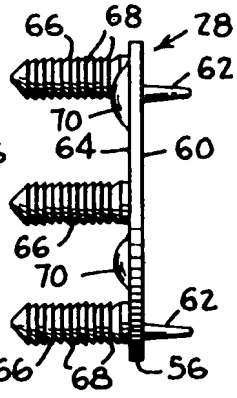

FIG-6

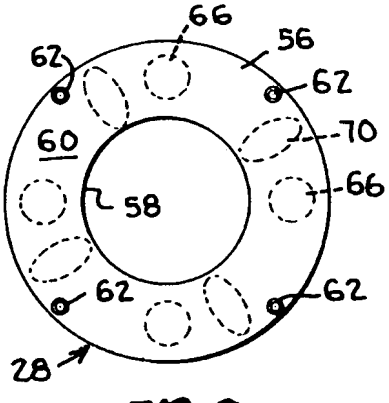

FIG-8

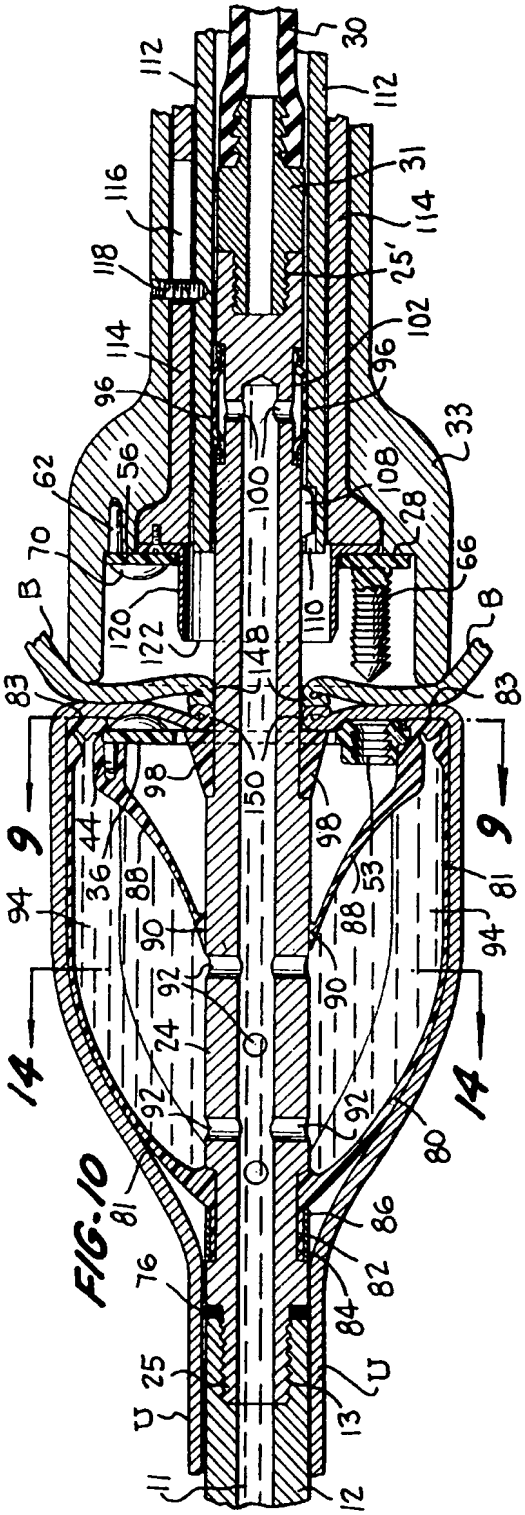

FIG-10

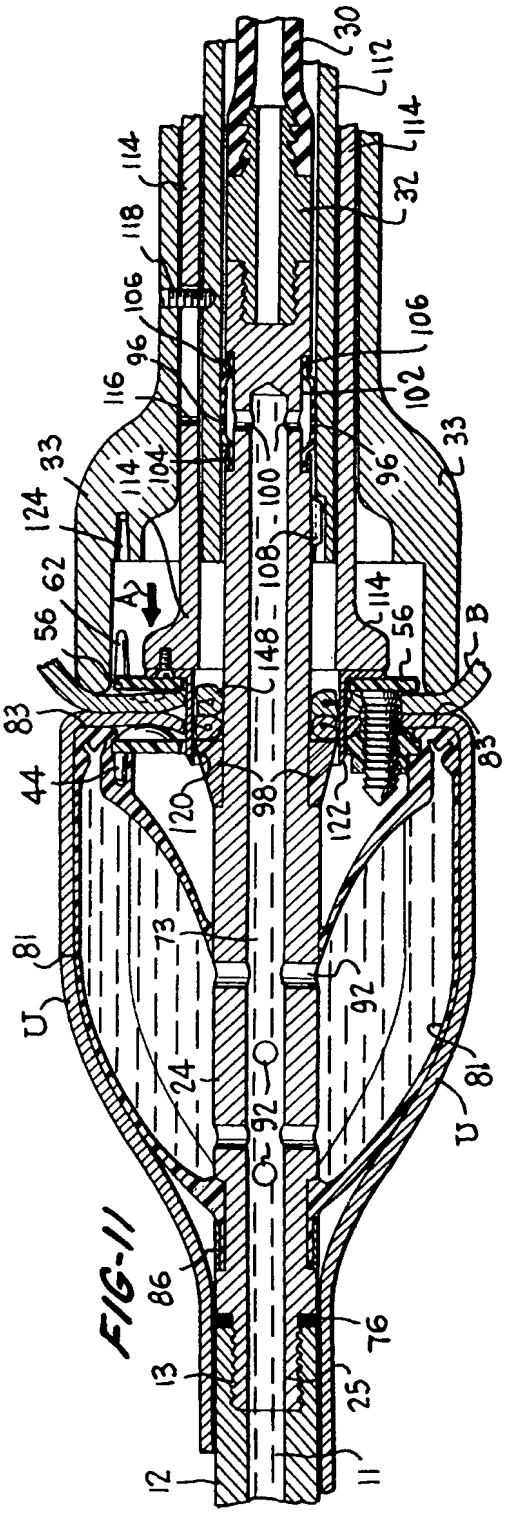

FIG-11

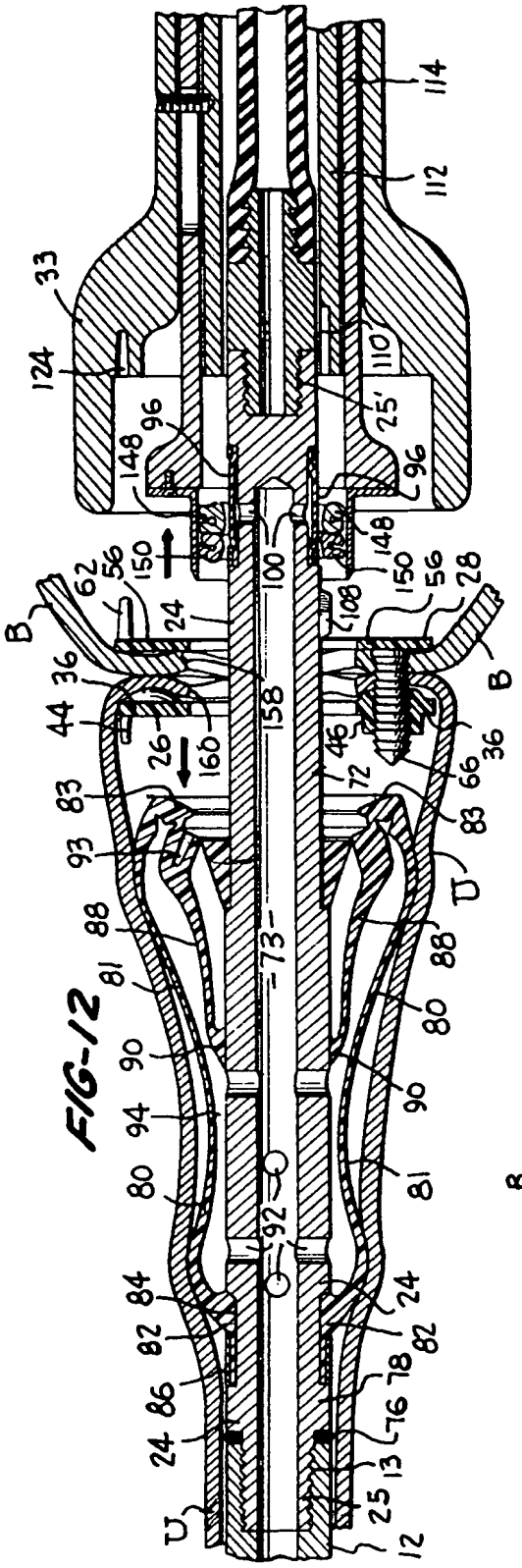

FIG-12

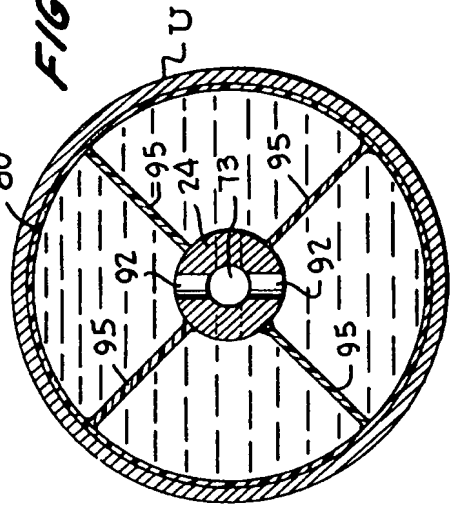

FIG-14

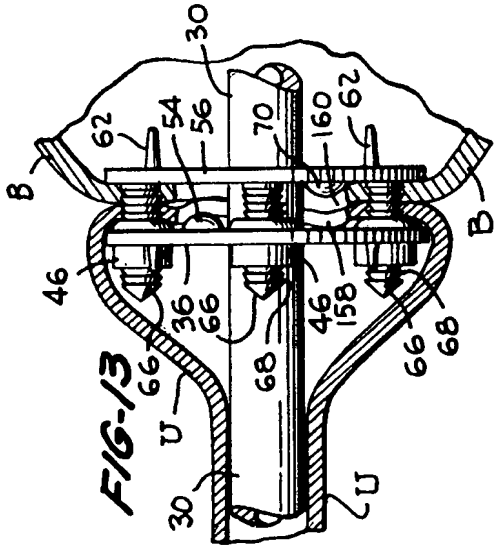

FIG-13